The Coal Situation

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NORTH AMERICAN ELECTRIC POWER SUPPLY & DEMAND 1985 – 1994

The North American Electric Reliability Council (NERC) recently published its annual survey of utility forecasts for electric power supply and demand in North America. The 1985 edition of the report *Electric Power Supply & Demand** provides, on an aggregated regional basis (see Figure 1), NERC-member utility forecasts of load requirements, capacity additions and fuel requirements for the years 1985 through 1994.

The purpose of this issue of *The Coal Situation* is to summarize and review the latest NERC projections as to their meaning to the coal producers of North America. The reader is reminded that the forecasts provided in this analysis are those released by the North American Electric Reliability Council and should not necessarily be construed as the opinion of The Chase Manhattan Bank.

NERC Projections of Annual Electrical Energy Demand

Nationally, NERC utilities are forecasting a growth in U.S. net annual electrical energy demand which averages 2.3 percent per year over the period 1984-1994 (1984 as base year). As shown in Table 1, projected regional growth in net energy for load ranges from a low of 1.6 percent per year in NPCC-U.S. (New York, Connecticut, Massachusetts, New Hampshire, Vermont and Maine) to 3.7 percent per year for ERCOT (Texas). As in last year's projections, these latest NERC forecasts continue to show stronger growth in electricity requirements in the South and Southwestern portions of the United States. This is consistent with the "Sunbelt" shift in regional economic and population growth patterns in the U.S.

As for Canada, Canadian utilities are forecasting a growth rate in annual electric energy demand of 3.0 percent per year over the period. Although regional adjustments have been made in the forecasts, the national rate of growth is essentially unchanged from last year's forecast. (see The Coal Situation, Vol. 4 – No. 4)

FIGURE 1
NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL

ECAR
East Central Area Reliability Coordination Agreement

ERCOT
Electric Reliability Council of Texas

MAAC
Mid-Atlantic Area Council

MAIN
Mid-America Interpool Network

MAPP
Mid-continent Area Power Pool

NPCC
Northeast Power Coordinating Council

SERC
Southeastern Electric Reliability Council

SPP
Southwest Power Pool

WSCC
Western Systems Coordinating Council

AFFILIATE

ASCC
Alaska Systems Coordinating Council

In the case of the United States, however, the latest projections of load requirements continue to exhibit decreases relative to previous forecasts. Last year, U.S. electric utilities

* A copy of NERC's report, *1985 Electric Power Supply & Demand for 1985-1994*, can be obtained from: North American Electric Reliability Council, Research Park, Terhune Road, Princeton, NJ 08540.

were projecting a ten-year (1984-1993) growth in net electricity requirements of 2.6 percent per year versus this year's 2.3 percent per year average rate of increase. In every NERC forecast since 1974, the project rate of growth for U.S. electricity requirements has been lower than the previous year's 10-year forecast.

NERC Projected Capacity Additions By Fuel Type

Even though exhibiting lower rates of growth than previously expected, the latest NERC projections show U.S. utility electricity demand in 1994 which is 26.0 percent greater than the 1984 actual. For Canadian utilities, net annual requirements for load is projected to increase by 35.0 percent by 1994 reaching 432.8 Twhr versus the 320.6 Twhr required in 1984.

TABLE 1

NERC PROJECTIONS OF NET ANNUAL ELECTRICAL ENERGY REQUIREMENTS FOR U.S. AND CANADIAN ELECTRIC UTILITIES

(Terawatt-hours)

NERC Region	1984 Actual	Projection 1985	Projection 1994	Average Annual Growth – %/Yr 1984-1994
ECAR	383.0	390.9	465.2	2.0
ERCOT	185.3	193.3	266.5	3.7
MAAC	186.0	188.3	219.7	1.7
MAIN	170.9	174.6	206.6	1.9
MAPP–U.S.	105.4	109.2	135.8	2.6
NPCC–U.S.	217.5	221.1	256.0	1.6
SERC	502.9	517.1	654.3	2.7
SPP	225.6	228.2	288.4	2.5
WSCC–U.S.	468.9	476.6	588.2	2.3
NERC–U.S.*	2,445.6	2,499.4	3,080.6	2.3
MAPP–Canada	25.7	25.9	33.5	2.7
NPCC–Canada	228.0	234.0	308.6	3.1
WSCC–Canada	66.9	68.7	90.7	3.1
NERC–Canada*	320.6	328.6	432.8	3.0

*Totals may not add due to independent rounding.

Source: NERC, *1985 Electric Power Supply & Demand for 1985-1994*, 1985.

To meet the growth in load requirements and to replace 12.4 gigawatts (GW) of planned unit retirements, U.S. electric utilities, in their submissions to NERC, are indicating plans to add 113.2 GW of generating capacity over the period 1985-1994. As shown in Table 2, U.S. utilities are currently anticipating the addition of 42.2 GW of coal-fired capacity and 46.3 GW of nuclear-based capacity over the decade. Together, these two energy sources represent 78.2 percent of total U.S. utility planned capacity additions over the period with the remaining additions represented by oil and gas, hydro, and others (wood, solar, blast furnace gas, etc.). In contrast, last year's projections showed U.S. utilities planning to add 56.3 GW of new coal-fired capacity and 55.1 GW of nuclear capacity between 1984 and 1993.

As for the Canadian utilities, a total of 15.0 GW of new generating capabilities is planned to be added by 1994 (planned Canadian retirements total 0.2 GW between 1985-1994). Nuclear, at 6.4 GW or 42.7 percent of the total is the principal form of new additions in Canada followed by hydroelectric facilities at 5.4 GW or 6.0 percent of the total. In third place is coal, with Canadian utilities anticipating the addition of 2.6 GW of capacity by 1994.

TABLE 2

NERC GENERATING UNIT ADDITIONS, RETIREMENTS, AND CONVERSIONS 1985-1994

(Gigawatts)

	United States Gigawatts	United States % of Total	Canada Gigawatts	Canada % of Total
Nuclear	46.3	40.9	6.4	42.7
Coal	42.2	37.3	2.6	17.3
Hydro	3.2	2.8	5.4	36.0
Oil/Gas	6.7	5.9	0.6	4.0
Pumped Storage	5.2	4.6	0.0	0.0
Cogeneration	6.6	5.8	0.1	0.0
Other	2.9	2.6	0.0	0.0
Total Additions*	113.2	100.0	15.0	100.0
Retirements	12.4		0.2	
Oil-to-Coal Conversions	4.5		0.0	

*Totals may not add due to independent rounding.

Source: NERC, *1985 Reliability Review, A Review of Bulk Power System Reliability in North America, 1985.*

Based on the planned additions outlined above and current unit capabilities, U.S. and Canadian utilities are projecting the share of net generation by fuel type shown in Table 3.

In Canada, the predomination of nuclear and hydroelectric capacity additions results in the sharp decline in the share of power generated by coal, falling from 22.7 percent in 1984 to 15.8 percent by 1994. While in the U.S. the share of power generated with coal is projected to decline slightly to 54.5 percent from its 55.4 percent share of generation in 1984.

TABLE 3

NERC PROJECTED SHARE OF ELECTRIC GENERATION BY ENERGY TYPE

(Percent)

	U.S. 1984 Actual	U.S. 1994 Forecast	Canada 1984 Actual	Canada 1994 Forecast
Coal	55.4	54.5	22.7	15.8
Nuclear	13.6	22.4	15.4	24.7
Hydro	13.8	8.5	60.8	57.6
Oil	4.6	4.1	0.7	0.5
Gas	12.2	7.8	0.5	1.1
Other	0.4	2.7	—	0.3
Total	100.0	100.0	100.0	100.0

Source: NERC, *1985 Electric Power Supply & Demand for 1985-1994*, 1985.

NERC Projected Coal Requirements

The NERC projections of the quantity of coal to be consumed in generating electricity between 1985 and 1994 are shown in Table 4. In 1994, U.S. utilities are anticipating the use of 815.5 million net tons of coal. This represents an increase of 160.4 million tons over the actual quantity of coal consumed in 1984, an average compound rate of growth of 2.2 percent per year between 1984 and 1994.

While total U.S. utility coal consumption is projected to increase, the regional projections provided by NERC indicates that the growth in coal usage will be concentrated in the regions of higher electricity demand growth which, coincidentally, are also less nuclear dependent. As shown in the table, coal consumption is expected to decline through the middle of the forecast period in the MAAC and MAIN regions

TABLE 4

NERC PROJECTED NORTH AMERICAN UTILITY COAL CONSUMPTION – 1985-1994

(1000 Net Tons)

REGION	ACTUAL 1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ECAR	165,900	170,675	163,706	166,843	173,849	179,022	180,139	180,158	182,542	184,609	188,095
ERCOT	53,156	52,430	54,924	59,052	62,623	63,812	66,007	75,057	83,832	94,920	99,011
MAAC	39,371	36,605	36,561	36,163	36,071	37,158	36,138	37,359	37,988	38,969	39,879
MAIN	57,406	56,131	54,324	50,503	51,467	52,275	53,577	54,526	55,555	56,461	56,958
MAAP–U.S.	51,310	53,357	53,005	55,958	58,854	59,458	59,313	60,370	60,712	62,426	64,589
NPCC-U.S.	14,433	15,721	14,940	16,192	18,204	19,422	19,847	19,776	20,097	20,094	20,370
SERC	124,631	131,922	130,904	131,577	130,868	132,557	137,770	137,379	141,177	143,637	145,347
SPP	66,375	69,898	71,815	75,311	77,922	78,662	81,574	82,160	85,119	89,789	94,766
WSCC–U.S.	82,534	84,617	87,056	90,662	94,255	96,626	96,445	98,679	101,070	103,218	105,442
NERC–U.S.	655,116	671,356	667,235	682,261	704,113	718,992	730,810	745,464	768,092	794,123	815,457
MAPP–CANADA	8,887	7,600	7,147	7,410	7,881	8,267	8,419	8,618	9,139	9,340	9,670
NPCC–CANADA	15,668	12,263	10,657	8,517	7,317	7,478	6,713	7,523	6,702	6,533	7,253
WSCC–CANADA	17,054	18,292	19,255	20,010	21,155	22,298	23,384	24,259	24,772	25,418	26,345
NERC –CANADA	41,609	38,155	37,059	35,937	36,353	38,043	38,516	40,400	40,613	41,291	43,268

Source: NERC, *1985 Electric Power Supply & Dem.. d 1985-1994*, 1985.

before recovering. This decline reflects the heavy dependence upon coal for power generation in these regions which, with the combination of lower anticipated growth in demand and the completion of nuclear power plant construction, forces the decreased use of coal for power generation. Once nuclear additions are completed, coal consumption at existing coal-fired power plants increases as electricity demand continues to grow.

While coal usage in U.S. power generation is forecasted to increase over the forecast period, the projected volumes are lower than those contemplated by NERC members last year. As shown in Table 5, this year's projected usage in 1994 is 10 million tons lower than last year's projected consumption for 1993. In fact, with the exception of 1985, this year's NERC projected coal usage by U.S. utilities has been reduced in each of the forecast years.

In contrast to the U.S., NERC projections for Canada indicates an increase in usage relative to the forecasts of 1984. This results from an improvement in the outlook for the use of coal for power generation in the NPCC-Canada region (Ontario).

TABLE 5

COMPARISON OF NERC'S 1984 AND 1985 PROJECTIONS OF NORTH AMERICAN UTILITY COAL CONSUMPTION

	United States			Canada		
	1984 Forecast	1985 Forecast	% Change 1985 vs 1984	1984 Forecast	1985 Forecast	% Change 1985 vs 1984
1984	646.3	655.1*	1.4	35.6	41.6*	16.9
1985	664.1	671.4	1.1	34.3	38.2	11.4
1986	679.2	667.2	–1.8	34.0	37.1	9.1
1987	695.4	682.3	–1.9	34.5	35.9	4.1
1988	717.9	704.1	–1.9	35.3	36.4	3.1
1989	737.4	719.0	–2.5	36.0	38.0	5.6
1990	750.3	730.8	–2.6	37.6	38.5	2.4
1991	771.7	745.5	–3.4	38.8	40.4	4.1
1992	800.7	768.1	–4.1	39.3	40.6	3.3
1993	825.6	794.1	–3.8	40.0	41.3	3.3
1994	–	815.5	NA	–	43.3	NA

*Actual 1984 Consumption
NA: Not Applicable

Source: NERC, *Electric Power Supply & Demand 1984-1993*, 1984 and NERC, *1985 Electric Power Supply & Demand for 1985-1994*, 1985.

As shown in Table 6, NPCC-Canada, more specifically Ontario Hydro, has significantly increased its projected use of coal in this year's forecast. Since the company imports almost 80 percent of its coal requirements from the U.S., this year's forecast represents a significant improvement in the outlook for the U.S. producers supplying this market.

TABLE 6

COMPARISON OF NERC'S 1984 AND 1985 UTILITY COAL CONSUMPTION FOR THE NPCC-CANADA REGION

(Million Net Tons)

	NPCC-CANADA		
	1984 NERC Forecast	1985 NERC Forecast	% Change 1985 vs 1984
1984	11.0	15.7*	42.7
1985	8.5	12.3	44.7
1986	7.4	10.7	44.6
1987	6.5	8.5	30.8
1988	5.4	7.3	35.2
1989	4.4	7.5	70.5
1990	5.1	6.7	31.4
1991	5.2	7.5	44.2
1992	4.4	6.7	52.3
1993	3.6	6.5	80.6
1994	–	7.3	NA

*Actual
NA: Not Applicable

Source: NERC, *Electric Power Supply & Demand 1984-1993*, 1984 and NERC, *1985 Electric Power Supply & Demand for 1985-1994*, 1985.

As for the sources of coal supply being projected by the U.S. NERC utilities, the majority of their anticipated requirements are forecasted to come from mines located west of the Mississippi River. As shown in Table 7, NERC has identified the geographical mining location for 138.2 million tons of the total 160.4 million tons of additional coal requirements to be consumed by U.S. electric utilities by 1994. Of the total for which mining locations have been indicated, 77.8 percent is projected to be mined west of the Mississippi River. The increased use of lignite represents 38.4 percent of the identifiable sources of coal supply, the vast majority of which (83.1 percent) is the result of the projected increase in the use of Texas lignites to be consumed by the utilities in NERC's ERCOT region.

TABLE 7

NERC PROJECTED SOURCES OF U.S. UTILITY COAL SUPPLIES

Coal Production Regions	Net Increase 1984-1994 (Million Tons)	Percent of Total Identified
East of Mississippi River & Imports	30.6	22.2
West of Mississippi River		
– Lignites	53.0	38.4
– Others	54.6	39.4
Total Identified Sources	138.2	100.0
Unidentified Sources	22.2	
Total	160.4	

Source: NERC, *1985 Electric Power Supply & Demand for 1985-1994*, 1985.

Summary and Conclusions

In summary, the latest NERC projections of North American electric power supply and demand indicates the continuation of the trend towards lower growth rates for electricity demand and production in the United States. This, in turn, has led to decreases in the projected use of coal for power generation relative to previous projections.

As a result, other than for the need to develop additional lignite operations, the latest NERC forecasts of the growth in the use of both eastern and western U.S.-produced coals are within the *existing* productive capabilities of the nation's coal industry. This is less than good news for U.S. coal operators and points to the continuation of the existing buyers market in coal.

Even in the case of the improvement in the outlook for U.S. exports to Canada, the news is less than favorable. For while this year's forecast of 7.3 million tons of consumption in 1994 is twice the quantity that was being forecasted by Ontario Hydro in last year's projection for 1993, it still represents a 40 to 50 percent decrease from historical consumption levels.

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INTERNATIONAL COAL TRADE — 1986

International coal trade reached new heights in 1985. Records were set in both segments of the market with 165.3 million metric tons (tonnes) of metallurgical coal and 169.6 million tonnes of thermal coal being traded. On a combined basis, the 333.9 million tonnes of coal traded in 1985 represents a 26.0 million tonnes (8.4 percent) increase over the previous peak established in 1984.

The purpose of this issue of *The Coal Situation* is to review the results and factors which influenced trade in 1985 and to provide an outlook for trade flows in 1986.

Review of 1985

Last year was a record year for the international coal markets. A new peak of 165.3 million tonnes of metallurgical coal trade was established, an increase of 7.9 million tonnes (5.0 percent) over the previous record established in 1984. This performance, however, was overshadowed by trade in thermal coal which increased by 18.1 million tonnes (12.0 percent) to 169.6 million tonnes. As a result, thermal coal represented over 50 percent of the total volume of international coal trade in 1985.

As shown in Table 1, North America represented the only geographic region showing significant decreases in coal imports for 1985. For both metallurgical and thermal coal, the decline in North American trade reflects the fall-off in Canadian imports from the United States.

As a result of stock build-up in anticipation of a 1984 United Mine Workers strike which did not materialize, Canadian imports of metallurgical coal from the U.S. declined by 0.6 million tonnes in 1985. As for thermal coal, increased availability of nuclear power in 1985 was the primary force leading to a decline of 3 million tonnes in Canadian imports. This was partially offset by an increase of 0.6 million tonnes in U.S. imports of thermal coal, yielding an overall decline of 2.4 million tonnes in North American thermal coal imports for the year.

In the other importing regions, the greatest volumetric increases in metallurgical coal imports were shown in the European Economic Community (EEC-12*) and Other Asia areas. India was primarily responsible for the growth shown for Other Asia, with additional imports also made by Korea

*Spain and Portugal joined the EEC on January 1, 1986.

TABLE 1

WORLD HARD COAL IMPORTS 1985 VERSUS 1984

(Million Metric Tons)

	Metallurgical Coal			Thermal Coal			Total		
	1984 (R)	1985 (P)	% Change	1984 (R)	1985 (P)	% Change	1984 (R)	1985 (P)	% Change
North America	7.0	6.4	−8.6	12.7	10.3	−18.9	19.7	16.7	−15.2
Latin America	9.3	11.0	18.3	0.5	0.7	40.0	9.8	11.7	19.4
EEC-12	35.8	37.8	5.6	65.7	68.7	4.6	101.5	106.5	4.9
Other W. Europe	8.9	9.3	4.5	6.7	8.2	22.4	15.6	17.5	12.2
Eastern Europe	12.9	13.4	3.1	25.6	25.8	1.2	38.5	39.2	1.8
Japan	69.3	70.1	1.2	18.5	22.8	23.2	87.8	92.9	5.8
Other Asia	10.9	13.5	23.9	16.5	25.6	55.2	27.4	39.1	42.7
Others	3.3	3.8	15.2	5.3	7.5	41.5	8.6	11.3	31.4
Total	157.4	165.3	5.0	151.5	169.6	12.0	308.9	334.9	8.4
Seaborne*	130.6	140.0	7.2	108.0	133.8	23.9	238.6	273.8	14.8

*Excluding overland, barge and lake deliveries
(R) Revised
(P) Preliminary

and Taiwan. Within the EEC-12, Italy and the United Kingdom accounted for the vast majority of the expansion in metallurgical coal imports in 1985.

On the thermal coal side, the Far East was the primary area of growth. In total, Japan and other asian countries accounted for 13.4 million tonnes of the total 18.1 million tonnes increase in thermal coal imports for the year. The growth in the Other Asia region was led by South Korea (+4.1 million tonnes), Hong Kong (+1.0 million tonnes) and Taiwan (+2.5 million tonnes).

In total, growth in imports by Japan and the Other Asia market accounted for 16.8 million tonnes of the total 26.0 million tonnes increase in world imports.

Among the other importing regions showing increased takes from the international market in 1985, the most significant was the EEC-12. As shown in Table 1, imports by the Community increased by 5 million tonnes. This expansion, however, was the net result of an increase of over 7 million tonnes in the Community's imports from third-party countries and an estimated decline of over 2 million tonnes of imports from other EEC member countries.

TABLE 2

EEC-12 HARD COAL IMPORTS FROM THIRD PARTY COUNTRIES

(Million Metric Tons)

				Percent Change	
	1983	1984	1985 (P)	1984/83	1985/84
Germany	7.94	8.25	9.15	3.9	10.9
France	12.88	16.70	15.17	29.7	-9.2
Italy	15.24	18.44	20.00	21.0	8.5
Netherlands	6.42	9.89	9.90	54.0	0.1
Belgium	5.04	6.72	6.54	33.3	-2.7
Luxembourg	0.12	0.16	0.15	33.3	-6.3
United Kingdom	3.70	7.15	11.30	93.2	58.0
Ireland	0.91	1.02	1.10	12.1	7.8
Denmark	7.09	9.09	11.00	28.2	21.0
Greece	1.42	1.86	1.70	31.0	-8.6
Spain	5.88	6.82	7.08	16.0	3.8
Portugal	0.31	0.44	1.20	41.9	172.7
Total	66.95	86.54	94.29	29.3	9.0

(P) Preliminary

Source: Eurostat, "Statistical Aspects of the Coal Economy in 1985" *Energy*, January 1986

The EEC member country imports from third-party countries are shown in Table 2. The most significant statistic to note in the table is the fact that the United Kingdom accounted for over 50 percent of the Community's increased imports from third-party countries in 1985. This reflects the results of its earlier protracted labor strike and subsequent rationalization of domestic production.

On the exporting side, only two major suppliers, West Germany and Poland, shipped less coal in 1985 than in 1984. The West German experience reflects lower levels of trade with its EEC partners, while the Polish experience reflects weather and production difficulties.

In part, the Polish experience contributed to the strong export performance by the United States, which, despite a strong dollar through most of the year, exported almost 13 percent more coal in 1985 than in 1984. This performance, however, was not sufficient to return the U.S. to the top spot among exporters, a position it relinquished to Australia in 1984.

With its own strong performance, Australia was able to maintain and expand its role as the world's largest coal exporter. While still lagging the U.S. in metallurgical coal trade, growth in its Asian market demand and inroads it has made in European sales combined to allow Australia to tie South Africa as the largest thermal coal supplier in 1985.

Before ending the review of 1985, a special note must be made of the introduction of thermal coal shipments from the Cerrejon Project in Colombia. In 1985, approximately 3 million tonnes of coal were exported by the project, which resulted in a 236.4 percent increase in the country's total exports. With the project's main port of Puerto Bolivar now in operation and mine development on schedule, shipments are expected to double in 1986.

Outlook for 1986

On the demand side, the primary factor influencing the outlook for coal trade in 1986 is the price of oil. While oil prices declined in 1985, imported coal maintained its competitive advantage. In fact, in many instances the cost advantage of imported coal widened as importers were able to leverage lower U.S. dollar coal prices owing to a more than adequate supply condition and deterioration in the

TABLE 3

WORLD HARD COAL EXPORTS 1985 VERSUS 1984

(Million Metric Tons)

	Metallurgical Coal			Thermal Coal			Total		
	1984 (R)	1985 (P)	% Change	1984 (R)	1985 (P)	% Change	1984 (R)	1985 (P)	% Change
United States	51.7	54.7	5.8	22.2	29.3	32.0	73.9	84.0	13.7
Australia	47.0	50.1	6.6	28.8	37.7	30.9	75.8	87.8	15.8
South Africa	4.8	4.8	0.0	33.3	37.7	13.2	38.1	42.5	11.5
Canada	21.1	22.8	8.1	4.1	5.0	22.0	25.2	27.8	10.3
Colombia	0.3	0.4	33.3	0.8	3.3	312.5	1.1	3.7	236.4
West Germany	6.9	5.9	-14.5	2.7	2.7	0.0	9.6	8.6	-10.4
United Kingdom	0.0	0.1	—	2.4	3.1	29.2	2.4	3.2	33.3
Poland	10.5	10.3	-1.9	32.6	25.8	-20.9	43.1	36.1	-16.2
USSR	9.8	10.6	7.1	13.9	13.3	-4.3	23.7	23.9	0.8
PRC	3.0	3.0	0.0	4.0	4.5	12.5	7.0	7.5	7.1
Others	2.3	2.6	13.0	6.7	7.2	7.5	9.0	9.8	8.9
Total	157.4	165.3	5.0	151.5	169.6	11.9	308.9	334.9	8.4
Seaborne*	130.6	140.0	7.2	108.0	133.8	23.9	238.6	273.8	14.8

(R) Revised
(P) Preliminary

principal producer countries' U.S. dollar exchange rates. However, 1986 is another matter.

Since the start of 1986, spot market oil prices have plummetted to levels which fall below the average break-even coal price for most suppliers. (See *The Coal Situation*, Vol. 5 — No. 4.) Even though average crude oil prices are still above the current spot market and product prices to the consumer do not fully reflect the decline in crude oil price that has occurred, unless production discipline of some form returns to the oil markets, consumer oil prices would continue downward, thereby jeopardizing coal. The impact of such an event, however, will not be fully felt in 1986.

On the one hand, contract commitments and/or technical constraints limit the ability of the consumer to quickly respond to a continued fall in oil prices. Clearly, if price justified, that portion of coal purchased on the spot market or under expiring contracts are the most sensitive to displacement by oil. However, coal suppliers will not just walk away from the market. Rather, when possible they will respond by lowering their own prices.

In this regard, it must be remembered that coal prices are affected by factor costs. Lower interest rates and lower costs for factors of production that are related to oil (e.g. fuels, lubricants, explosives, etc.) provide some flexibility to the coal supplier for reducing price. Further, lower transport fuel costs (bunker fuel) also serves to automatically reduce the delivered price of coal to the consumer.

Finally, of course, is the positive effect that oil prices (and lower coal prices) will have on economic activity. Stronger than previously expected economic growth leading to higher electricity demands, stronger steel markets, increased cement production, etc., in turn, leads to in creased total energy demands. The benefits coal derives from this growth pehnomenon would partially offset the displacement effect of very low oil prices.

The above considerations when taken along with the uncertainty over whether or not stability returns to the oil market, produces the range in forecasted 1986 coal trade shown in Table 4.

The low forecast reflects the assumption that crude oil prices average $10/bbl. to $12/bbl. in the second half of the year. The high forecast reflects an assumption that oil prices recover to $20/bbl. while the medium forecast reflects an assumption of $15/bbl. to $16/bbl. average crude oil prices. As shown in the table, these price assumptions coupled with uncertainty surrounding other key forecasting parameters (economic growth, etc.), lead to a forecast of metallurgical coal imports ranging from a low of 161.6 million tonnes to a high of 171.5 million tonnes. Thermal coal import requirements are forecasted to fall between 157.0 million metric tonnes and 183.4 million tonnes.

Since the assumed average crude oil prices under the medium and high forecast scenarios are above the break even delivered price of coal, (roughly $12/bbl. to $15/bbl.) relatively little of the variation in quantities under these two scenarios are directly related to oil displacement. Rather, the majority of variability between the medium and high forecasts is the result of the uncertainty concerning the positive effects lower oil prices will have on economic activity, particularly in Europe and Japan.

On the downside case, however, the low oil price assumption leads to oil substitution, primarily appearing in the second half of the year. In the case of the low metallurgical coal forecast, fuel oil injection in the blast furnace leads to reduced imports in 1986. While in the thermal coal sector, oil prices below $15 per barrel would lead to some substitution of coal in cement kilns and electric

TABLE 4

WORLD HARD COAL TRADE FORECAST

(Million Metric Tons)

	Metallurgical				Thermal				Total			
	1985	1986			1985	1986			1985	1986		
	(P)	Low	Med.	High	(P)	Low	Med.	High	(P)	Low	Med.	High
Importers												
North America	6.4	6.4	6.4	6.8	10.3	9.8	10.3	10.3	16.7	16.2	16.7	17.1
Latin America	11.0	11.5	11.5	12.0	0.7	0.8	0.8	1.2	11.7	12.3	12.3	13.2
EEC	37.8	37.0	38.6	39.8	68.7	60.6	66.8	69.0	106.5	97.6	105.4	108.8
Other W. Europe	9.3	9.3	9.6	10.0	8.2	7.5	8.7	9.2	17.5	16.8	18.3	19.2
Eeastern Europe	13.4	13.8	13.8	14.2	25.8	26.1	26.4	27.0	39.2	39.9	40.2	40.6
Japan	70.1	66.0	69.0	70.0	22.8	18.1	24.0	26.3	92.9	84.1	93.0	96.3
Other Asia	13.5	13.8	14.0	14.3	25.6	27.0	30.1	31.6	39.1	40.8	44.1	45.9
Others	3.8	3.8	4.2	4.4	7.5	7.1	8.2	8.8	11.3	10.9	12.4	13.2
Total	165.3	161.6	167.1	171.5	169.6	157.0	175.3	183.4	334.9	318.6	342.4	354.3
Exporters												
United States	54.7	53.2	55.5	56.9	29.3	23.0	28.6	30.5	84.0	76.2	84.1	87.4
Australia	50.1	48.8	50.6	52.4	37.7	34.9	39.2	42.1	87.8	83.7	89.8	94.5
South Africa	4.8	4.8	4.8	4.8	37.7	33.4	38.2	40.0	42.5	38.2	43.0	44.8
Canada	22.8	22.0	23.1	23.9	5.0	4.9	5.7	6.0	27.8	26.9	28.8	29.9
Colombia	0.4	0.4	0.4	0.4	3.3	6.3	6.3	6.3	3.7	6.7	6.7	6.7
Poland	10.3	10.3	10.3	10.3	25.8	24.8	25.8	25.8	36.1	35.1	36.1	36.1
USSR	10.6	10.5	10.7	11.0	13.3	13.2	13.2	13.5	23.9	23.7	23.9	24.5
PRC	3.0	3.0	3.1	3.1	4.5	4.5	5.0	5.5	7.5	7.5	8.1	8.6
Others	8.6	8.6	8.6	8.7	13.0	12.0	13.3	13.7	21.6	21.2	20.6	22.4
Total	165.3	161.6	167.1	171.5	169.6	157.0	175.3	183.4	334.9	318.6	342.4	354.9
Seaborne	140.0	136.4	141.9	146.3	133.8	123.5	140.8	148.6	273.8	259.9	282.7	294.9

(P) Preliminary

power generation in Europe and Japan. However, these effects are partly offset by the full-year use of new power plants brought on-line in 1985 and the addition of new power plants in other importing regions.

On the export side, the variations in supplier shares between scenarios reflect relative economic positions and contractual commitments. Also recognized are the announced trade policies of European importers such as France and Denmark which call for the phasing out of purchases from South Africa.

South African exporters are capable of producing and shipping 40 million tonnes or more of thermal coal and have the capacity to reduce prices to match or beat even $9/bbl to $10/bbl oil prices. However, under the low and medium forecasts, the country's exports have been constrained to reflect European policy objectives. It is, therefore, important to recognize that under the low oil price scenario it is possible for South African suppliers, because of price, to gain up to an additional 5.0 million tonnes of sales. Volumetrically, the displacement impact of this occurrence would fall primarily on the United States and Australia. All suppliers would be affected price-wise.

In conclusion, while the present oil price situation is unsettling for the coal market, its impact on coal trade in 1986 is expected to be relatively small.

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COMPETING WITH LOW OIL PRICES IN THE INTERNATIONAL MARKETS

The September, 1985 issue of The Coal Situation (Vol. 5 – No. 4) analyzed the level to which oil prices had to fall to challenge the economic attractiveness of coal in thermal applications. Using actual reported 1985 imported (CIF) coal prices and differences in the variable operating costs of oil- and coal-fired power plants, it was determined, that for existing coal users, heavy fuel oil (HFO) prices had to average approximately $15 per barrel to make the cost of oil-fired power generation equal to the cost of generating with coal. This HFO breakeven price translated into a crude oil price of almost $17 per barrel assuming a 0.9:1 HFO-to-crude-oil-price ratio. At the time, world average crude oil price stood at $27-28 per barrel. This led to the conclusion that "barring a collapse of OPEC's production sharing system and a subsequent price war, existing thermal coal markets are relatively stable." Needless to say the production sharing system has collapsed and oil prices have plummeted. At the time of this writing, spot cargos of 1% sulfur HFO are being offered at $11 per barrel FOB barge Rotterdam. Given the state of today's oil market it is now appropriate to reverse the analytical process. Therefore, the purpose of this issue of The Coal Situation is to examine the coal prices that would be needed to remain competitive with oil in the international markets.

The analysis concentrates on the existing export markets for coal used for electric power generation. It, therefore, relies upon the differences in the variable costs of electricity generation to determine the FOB pier price of coal that, when delivered and used to generate electricity, results in total variable costs equal to the variable cost of generating electricity with oil.

Crude Oil Prices and Required Delivered Coal Prices

Table 1 shows the estimated delivered energy cost of coal ($/MMBtu) needed to remain competitive with heavy fuel oil (HFO) under five crude oil prices levels and three HFO-to-crude-oil price ratios. That is, a US$8.00 per barrel crude oil price would produce HFO prices of US$6.40 per barrel, US$7.20 per barrel and US$8.00 per barrel, respectively, at a 0.8:1.0, 0.9:1.0 and a 1.0:1.0 HFO-to-crude-oil price relationship. Assuming an HFO heat content of 6.3 million Btu per barrel, these per barrel fuel oil prices translate into HFO energy costs of $1.02, $1.14, and $1.27 per million Btu (MMBtu), respectively. With a crude oil price of $16 per barrel, a similar calculation yields HFO energy costs of $2.03, $2.29 and $2.54 per MMBtu.

Based purely on economics, if there were no differences in the variable costs of generating electricity with coal versus oil, the per million Btu HFO energy costs shown in Table 1 would represent the delivered per million Btu energy cost of coal needed to just match the variable cost of generating electricity with oil. However, coal-fired power plants generally have higher variable operating costs which must be offset by the delivered energy cost of coal to attain a "breakeven" or consumer indifference point with oil. The adjustment in the delivered energy cost of coal to offset higher operating costs are provided in the segment of Table 1 entitled "Required Delivered Energy Cost of Coal." The figures shown in this portion of the table reflect an assumption that the operating cost of a coal-based facility averages 2.5 mills per kilowatt-hour ($0.0025/Kwhr) higher than an oil unit. In addition, it is assumed that to generate a kilowatt-hour of power requires 10,000 Btu of coal versus 9,500 Btu of oil. In reality, there exists a very wide range of differences in the non-fuel operating expenses and heat rates between oil-fired and coal-fired facilities. For this analysis, however, these assumptions provide an accurate assessment of the market in general.

As shown in Table 1, to compete with $1.02 per MMBtu HFO ($8.00/bbl crude at a 0.8:1.0 HFO-to-crude-oil-price

ratio) coal would have to be delivered at $0.71 per MMBtu. As shown in Table 2, for a 11,500 Btu per pound coal product, this translates into a required delivered coal price of $18.00 per metric ton (tonne). For a 12,500 Btu per pound product, the required delivered price would be $19.56 per tonne. At these delivered prices, the total variable cost of generating a kilowatt-hour of electricity using coal is equal to the total variable cost of generating electricity with heavy fuel oil.

TABLE 1

CRUDE OIL PRICES AND REQUIRED DELIVERED (CIF) COAL ENERGY COSTS

	Crude Price $/bbl				
	$8.00	$10.00	$12.00	$14.00	$16.00
HFO $/bbl@					
0.8 Crude Price	6.40	8.00	9.60	11.20	12.80
0.9 Crude Price	7.20	9.00	10.80	12.60	14.40
1.0 Crude Price	8.00	10.00	12.00	14.00	16.00
HFO Energy Cost $/MMBtu					
0.8 Crude Price	1.02	1.27	1.52	1.78	2.03
0.9 Crude Price	1.14	1.43	1.71	2.00	2.29
1.0 Crude Price	1.27	1.59	1.90	2.22	2.54
Required Delivered Energy Cost of Coal $/MMBtu*					
0.8 Crude Price	0.71	0.95	1.19	1.43	1.68
0.9 Crude Price	0.83	1.10	1.37	1.64	1.92
1.0 Crude Price	0.95	1.25	1.55	1.86	2.16

*HFO Energy Cost ($/MMBtu) adjusted to reflect higher efficiency (9,500 Btu/Kwhr vs 10,000 Btu/Kwhr) and lower non-fuel variable operating costs (2.5 mills/Kwhr or $.0025/Kwhr) of an oil-fired power plant.

TABLE 2

REQUIRED DELIVERED (CIF) PRICES FOR COAL TO REMAIN COMPETITIVE WITH OIL

($ Per Metric Ton)

	HFO-to-Crude-Oil-Price Ratio & Coal Heat Content MMBtu/lb.								
	0.8			0.9			1.0		
Crude Oil Price	11,500	12,000	12,500	11,500	12,000	12,500	11,500	12,000	12,500
$ 8.00/bbl	18.00	18.78	19.56	21.04	21.95	22.87	24.08	25.13	26.17
10.00/bbl	25.08	25.12	26.17	27.88	29.09	30.31	31.68	33.06	34.44
12.00/bbl	30.16	31.47	32.78	34.72	36.23	37.74	39.29	40.99	42.70
14.00/bbl	36.24	37.82	39.40	41.57	43.37	45.18	47.14	49.19	51.24
16.00/bbl	42.58	44.43	46.28	46.55	50.78	52.89	54.75	57.13	59.51

Required Export (FOB Pier) Prices

Table 3 shows the FOB pier export prices that would be needed for coal to match the cost of oil-fired power generation in the European and Asian markets for the various crude oil and HFO price assumptions used in this analysis. The Australian prices are based on a coal product of 12,000 Btu per pound and shipping costs of $8.00 per tonne to Europe and $4.50 per tonne to the Asian markets. The South African export prices assume a coal product of 11,500 Btu per pound with shipping costs of $5.50 per tonne to both markets. The United States and Canadian prices are based on 12,500 Btu per pound. U.S. shipping costs are assumed to be $4.00 per tonne into Europe and $8.00 per tonne into Asia while Canadian shipping costs are $5.00 per tonne to Asia and $9.00 per tonne to Europe.

Of key importance are the numbers highlighted in Table 3. The required FOB pier prices shown in this bracketed segment of the table reflect prices which fall below the lowest representative cash costs of delivering coal to port for the countries shown. Cash costs in these instances are defined to be the cash costs of mining plus the costs of rail transport to the pier plus pier loading costs. In short, the required FOB pier prices shown in the bracketed portion of Table 3 represent price levels which would force existing coal suppliers out of the market.

For instance, regardless of the HFO-to-crude-oil-price ratio, Australian suppliers would find it impossible to continue supplying the European market if crude oil prices were at $8 to $10 a barrel. As a reference point, current FOB pier prices for Australian thermal coal exports are in the range of US$32-

$35 per tonne. As shown in the table, the low-end of current Australian prices is competitive in Europe at a $12.00/bbl crude oil price and a 1:1 HFO-to-crude-oil-price ratio.

On a broader scale, in both the European and Asian markets, United States and Canadian suppliers are the most sensitive to falling oil prices. In general, crude oil prices of $14 per barrel or less would force existing suppliers in these countries out of the export market. Part of this market would shift to the lower cost suppliers, namely Australia and South Africa. This would occur up to the point that these suppliers possess incremental capacity at existing mines or where cheap incremental expansions are possible. At oil prices of $10 per barrel or less, Australia would exit the market leaving only South Africa capable of competing on a cash cost basis with oil. As for South Africa, crude oil prices would have to fall to the $8 per barrel range to force out existing coal suppliers. At $8 per barrel, coal would have been displaced by oil in the international markets. This, of course, assumes that the consumer, for one reason or another, would be unwilling to pay a premium for coal.

TABLE 3

REQUIRED FOB PIER PRICES FOR EXPORT COAL TO REMAIN COMPETITIVE WITH OIL

($ Per Metric Ton)

Market & Crude Oil Price	Exporter & HFO-to-Crude-Oil-Price Ratio											
	Australia			South Africa			United States			Canada		
EUROPE	0.8	0.9	1.0	0.8	0.9	1.0	0.8	0.9	1.0	0.8	0.9	1.0
$ 8.00/bbl	10.78	13.95	17.13	12.50	15.54	18.50	15.56	18.87	22.17	10.56	13.87	17.17
10.00/bbl	17.12	21.09	25.06	18.58	22.38	26.18	22.17	26.31	30.44	17.17	21.31	25.44
12.00/bbl	23.47	28.23	32.99	24.66	29.22	33.79	28.78	33.74	38.70	23.78	28.74	33.70
14.00/bbl	29.82	35.37	41.19	30.74	36.07	41.64	35.40	41.18	47.24	30.40	36.18	42.24
16.00/bbl	36.43	42.78	49.13	37.08	43.16	49.25	42.28	48.89	55.51	37.28	43.89	50.51
ASIA	0.8	0.9	1.0	0.8	0.9	1.0	0.8	0.9	1.0	0.8	0.9	1.0
$ 8.00/bbl	14.28	17.45	20.63	12.50	15.54	18.50	11.56	14.87	18.17	14.56	17.87	21.17
10.00/bbl	20.62	24.59	28.65	18.58	22.38	26.18	18.17	22.31	26.44	21.17	25.31	29.44
12.00/bbl	26.97	31.73	36.49	24.66	29.22	33.79	24.78	29.74	34.70	27.78	32.74	37.70
14.00/bbl	33.32	38.87	44.69	30.74	36.07	41.64	31.40	37.18	43.24	34.40	40.18	46.24
16.00/bbl	39.93	46.28	52.63	37.08	43.16	49.25	39.28	44.89	51.51	41.28	47.89	54.51

Summary and Conclusions

The purpose of this analysis was to determine the prices for export coal that would be required for coal to remain economically competitive with HFO for electric power generation by existing coal consumers.

Relying upon generalized assumptions, the analysis concluded that if the consumer is driven purely by economics in his fuel selection, higher cost coal suppliers (i.e. U.S. and Canada) are unable to cover cash costs and would be forced out of the market when crude oil prices fall below $12 per barrel. At $10 per barrel, Australian suppliers exit leaving only South Africa and other very low cost suppliers in the market. At $8 per barrel, South Africa is eliminated. This would leave the power generating sector now being served by imported coal entirely to oil. While theoretically accurate, realities suggest something to the contrary.

First, no recognition has been given to the ability of coal suppliers to reduce operating costs through improvements in productivities, changing work rules, lower diesel costs, etc. In addition, no recognition has been given to the potential for lower freight rates to port should the railroads see their markets deteriorating.

Second, there is the issue of diversity of energy source and diversity of supply. The key issue being what premium the consumer is willing to pay in order to maintain a fuel mix in power generation.

A final consideration is the effect of market dynamics on the price of oil. A shift to oil of the magnitude suggested by an oil price of $8 to $10 a barrel brings into question the sustainability of such prices.

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